

**Status and Knowledge of Waterborne Disease  
Among Residents in Kep, Cambodia  
Summer 2005  
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**Introduction**

Since access to safe water according to National Institute of Statistics in Cambodia in rural areas was just under 50% in 1999, a marked contrast with the 95% of Phnom Penh (See Figure 1)<sup>1</sup>, it is not surprising that the spread of waterborne diseases remains at high levels. Likewise, rural sanitation is only 9% compared to 49% in the urban counterpart according to the Sanitation, Agriculture, Water, and Agronomy in Cambodia (SAWAC)<sup>2</sup>. To address the spread of waterborne diseases, it is necessary that the foundations of water infrastructure be examined. This report looks specifically at the water distribution/sanitation system that is in place for a rural region of Cambodia, Kep.

Figure 1

During the Khmer Rouge reign, it was the ambitious plan of the leaders to create a super irrigation system that would be functional independent of the rainfall. This water system would also have been helpful to provide reservoirs of water, which could be used as water sources for drinking. However, because those with technical expertise had been killed or fled, many of the irrigation canals were built improperly without regard to contour lines. Consequently, most of the irrigation structure built in this time period is quite useless for future water management. Thus, Cambodia was very much set back in terms of rural development during this period<sup>3</sup>.

<sup>1</sup> CAMInfo Cambodia database CD version 1.1 with CIPS data, March 2004.

<sup>2</sup> SAWAC's *Rural Water Supply & Sanitation Project: Final Report*, Aug. 15, 2002.

<sup>3</sup> Sinath, Chann. "Investment in land and water in Cambodia." Published by Food and Agricultural Organization of the United Nations, March 2002.

As the current Cambodian per capita GDP is only US\$290 with 36% of the population below the poverty line, the Royal Government of Cambodia is committed to decreasing poverty via socioeconomic development<sup>4</sup>. The provision of safe drinking water and sanitation is a top priority to achieve this poverty reduction and one of the key contributors to an increased standard of living and economic growth. Rural agriculture accounts for approximately half of the GDP and 90% of employment, thus access to water is crucial<sup>5</sup>. It is important to recognize that despite the fact that this report deals mostly with access to potable water in a household environment, the issue of water provision is so complex that all aspects of the system must be considered including those involving agriculture. Kep is one such remote and vulnerable area in Cambodia that could very much benefit from socioeconomic development, especially in the realm of water sanitation, as there has been relatively little government assistance on this issue.

## Kep

Figure 2

The province of Kep is a small rural area at the southernmost region of Cambodia along the coast of the Gulf of Thailand, just a few hours away from Vietnam. The predominant industry is farming, while vendoring and tourism activities also play a small role in the economy. The province is divided into 5 communes: Okrasa, Prey Thum, Pong Tuok, Angkoul,

and Kep. Each of the communes are comprised of villages, totalling 16 in the entire province. **Figure 2** shows the population in each village. The communes are grouped together in districts; Kep, Okrasa, and Prey Thum belong to the Kep district, while Pong Tuok and Angkoul are part of the Damnak Chan Aeur district. The climate of Cambodia is tropical with the dry season spreading over March to May only, and the remaining months are considered wet. During the time that this study was conducted in Cambodia, it was peak rainy season.

[http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/docrep/005/ac623e/ac623e0c.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/ac623e/ac623e0c.htm)

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

The social hierarchy in the Kep villages is typical of any Cambodian village. The elected village elder acts as the general leader of the village; he organizes events and can make decisions on behalf of the village. In terms of medical help, villagers have several options: traditional healers, red cross volunteers, traditional birth attendants (TBAs) for birthing concerns, health centres, pharmacies, call-in medical help, and hospitals. Often the hospital and health centres can be several kilometres away, and many resort to solicitation of the pharmacies.

It is useful to elaborate in describing these medical help sources. The pharmacies more aptly can be described as drug sellers since the vendors are not necessarily knowledgeable of the drugs being sold, and drugs sold are often named under the ambiguous title, 'For fever', etc. The pharmacies often provide patients with an injection, which usually acts as a placebo, but there is a perception that an injection acts as the panacea for all illnesses. The health centres are usually run by employees who are more educated than the average population (i.e. finished high school). These centres are not meant for highly advanced or complicated medical illnesses; for these, the patient needs to be referred to the hospital. The health centres as well as the referral hospital are open only during the morning from about 7:00am-11:00am, but this is variable depending on the number of patients and weather, which could lead to early closure. Some of the doctors at the hospital then choose to work in the afternoon as a call-in doctor.

The one referral hospital in Kep itself is not equipped to deal with all medical illnesses, and for complications that require more advanced surgery, the patient would be referred to a larger hospital for example in Phnom Penh. The Rose clinic at the Referral Hospital does provide some basic surgery. Upon shadowing of doctors at the Referral Hospital, there was opportunity to peruse the medical cabinet. Basic drugs such as those for hypertension, NSAIDS, ampicillin, paracetamol (acetaminophen), antifungal drugs, folic acid for antenatal care,  $\beta$ -blockers, anti-seizure drugs, and saline were present. It was observed that there were usually 1-2 options for the major drug classes, but these were most often older versions of that class of drug.

## **Water Sanitation Background**

Very limited research has been done in Kep regarding water access. Basic statistics regarding distances to water sources, households with latrines, and details about the wells used were acquired from Seila, which is part of Cambodia's Department of Planning under the Provincial Department of Rural Development. The previously mentioned NGO, SAWAC, has done extensive work developing wells in rural areas in Cambodia and was tremendously useful in understanding how water infrastructure is created.

SAWAC is a NGO stationed in Phnom Penh with a network that includes the government, other NGOs, and the private sector. The NGO aims to help in particular, Cambodia's poorer population. Services geared to improve quality of life include strengthening capacity, skills, transfer, community work, research studies, and development of infrastructures<sup>6</sup>. When SAWAC decides to build a new well, villagers are surveyed and the area of interest is mapped to develop a Rural Participation and

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<sup>6</sup> SAWAC: Consultants for Development. <<http://www.sawac.com/>>

Assessment study. The community development team then goes to the chosen village to organize a Water Source User's Group (WSUG), which is formed from village volunteers who are taught how to clean and maintain the well. In fact, SAWAC has not done work in Kep yet, but in adjacent provinces. According to Mr. Chun Bunnarin<sup>7</sup>, head of the rural development department at SAWAC, the NGO hopes to extend its services to Kep in the near future.

SEILA is a government program whose aim is to decentralize rural development by working with the communes and will be 5 years old in 2006. The program has achieved supported this decentralization by working with external development assistance<sup>8</sup>. According to Mr. Leng Naph<sup>9</sup>, Senior Provincial Programme Advisor, the dug wells are each supposed to provide for 20 families and each cost about \$600. These dug wells are limited to being built around the road. Drilled wells are not funded by SEILA in Kep because of lack of the high tech equipment required. More Kep specific data regarding water sanitation was acquired from SEILA in several yet unpublished documents. The ratio of families to latrine in the entire province in 2004 was 15.6. Figure 3 illustrates this data by village.

In terms of water sources, Figure 4 illustrates that the minority of households have water close to the house. Although not explicitly stated in the SEILA documents, it can be assumed that "Other" refers to remote wells, ponds, or lakes. The latter two tend to be of much poorer quality than wells, as cattle and other animals are free to roam near and in these water sources.

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<sup>7</sup> Interview with Mr. Chun Bunnarin, June 27, 2005.

<sup>8</sup> <http://www.worldbank.org/wbi/reducingpoverty/case-Cambodia-SeilaProgram.html>

<sup>9</sup> Interview with Mr. Leng Nath, July 18, 2005.

Figure 3

Figure 4

In addition to this, Red Cross has made efforts to distribute ceramic water purifiers to various households in each village last year as summarized in Table 1. The priority is given to the poorest villages and awards those who demonstrate an improvement in their habits to reduce the spread of waterborne disease.

<b>Table 1: Red Cross Water Purifiers</b>	
<b>Village</b>	<b># of purifiers given</b>
Angkoul	35
Chumkabey	35
Roneas	35
Prey Takoy	35
Koh Soam	35
Aumpeng	35
Phnom Leav	35
Toul Sangam	35
Ou Dang	35
Kampon Tra Lach	57
Kep	58
Okrasa	134
Thmei	58
Damnak Chom Bok	140
Koe Kra Sang	58
Damnak Chang Aeur	140
<b>TOTAL</b>	<b>869</b>

One of two types of purifier is given. It was observed during research for this project, that the red Rabbit purifier, which costs \$7.50, was more prevalent than the alternative grey purifier, which costs \$10.00. During an interview with a Red Cross volunteer, he told us that villagers are taught how to use, clean, and take care of the water purifier. A purifier is given to a household. Although the purifier can reduce the level of microbes in water by 70%, it is not 100% effective, and it was observed that households with the purifier still had members who became sick; however, the purifier does offer some protection. Funding for this project came from the UK and New Zealand.

### **Rationale/Purpose of Study**

The government's 2012 goal is to increase rural water supply coverage to 45% and sanitation to 30%<sup>10</sup>. In the meantime, the purpose of this report is to evaluate the level to which waterborne disease is a problem in one rural area of Cambodia, Kep, and to suggest solutions to improve the situation. This topic was selected as no prior research of this nature has been conducted in Kep. Despite the fact that improved rural sanitation does rely heavily on a better infrastructure, there are other aspects, behavioural and social, that contribute to this complex issue of accessing safe water. This project seeks to elucidate some of these aspects while providing a

<sup>10</sup> SAWAC's Rural Water Supply & Sanitation Project: Final Report, Aug. 15, 2002.

brief overview of the existent infrastructure in Kep. The final recommendations emphasize prevention of waterborne disease incidence.

## Methodology

Prior to leaving Toronto, a proposal was written during the application process for this research project. A simple timeline (See Appendix I: Timeline) was drafted during this time to keep the project on schedule.

The cross-sectional survey format was chosen because a large number of questions could be asked within a short period of time. Given that the study time period was only 2.5 months, this was ideal. Most questions were qualitative because it provided a sufficiently open platform to investigate an issue that had not hitherto been studied in Kep; for most, the answers were then categorized to make for easier analysis. Standard qualitative techniques for interview design were followed to evaluate practices and knowledge of water sanitation. The interview adhered to the schedule standardized interview, where “the wording and order of all questions are exactly the same for every respondent”<sup>11</sup> with minimal changes from the script. During writing of the interview questionnaire, double-barrelled, ambiguous, and leading questions were all avoided<sup>12</sup>. A consent form was drafted based on the one used for the course, Determinants of Community Health II; however, because many respondents were illiterate, the translator, Mr. Khut Chim, would sign on behalf of the respondent after orally reading out the consent form in Khmer (See Appendix II: Consent Form). Demographic questions were asked first in section A of the questionnaire to make the client more comfortable before asking more involved questions (See Appendix III: Interview Questionnaire Form).

Section B involved investigating the incidence of waterborne disease and what was done by a household should someone be ill with a waterborne disease. Since there is no definite diagnosis in many of these cases, the symptoms of vomiting and/or diarrhea were taken as representative of a sickness with a waterborne disease. It has been observed that a person’s recall beyond 2 weeks tends to be inaccurate; thus, respondents were asked if they remembered anyone in the household who was sick in the past 2 weeks. After assessing the severity of illness if a household member had been ill, the survey goes on further to explore the remedies that the household utilizes if a member is ill. The respondent is asked who the medical help source would be and what type of advice is usually given. The topic of oral rehydration salts (ORS) is briefly explored because dehydration is complication common to diarrhea/vomiting. Respondents were asked whether they knew where ORS could be obtained and whether they could afford it.

Section C dealt with knowledge about dehydration and was simply a scenario-based set of questions. The scenarios were derived from an education package used by SAWAC during health education sessions. The point of this section was to ascertain whether respondents knew when it was critical to seek help: 3 days of severe water loss, blood in the diarrhea, unawareness of surroundings/weakness, and fever. The other questions regarding lack of urination over 12 hours, lack of tears produced by a

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<sup>11</sup> Polgar Steven and S Thomas. *Introduction to Research in the Health Sciences*, 4<sup>th</sup> ed. Churchill-Livingstone. 2000. p. 115.

<sup>12</sup> Ibid.

child, dry skin (or lack of skin turgor), and blurred vision were perhaps more sophisticated; these reflect more serious signs of dehydration. It was not expected that many villagers would have encountered these, but it was interesting to note whether they felt these signs would have been cause for concern.

Section D investigated the behavioural practices of villagers, which might be preventing them from having safe water. These questions looked at hand washing practices, water-boiling practices, water sources, location of washing, location of urination/defecation, water storage, swimming, and ownership of a water purifier.

Several drafts of the questionnaire were revised according to the input of multiple colleagues and with extensive discussion with the Mr. Chim. The survey was rehearsed prior to pilot testing.

Once the questionnaire had been designed, the questionnaire and the project proposal written prior to arrival in Cambodia were submitted to the Ministry of Health Director in Kep, Dr. Men Sothy, for formal ethics approval. Before our arrival, there had already been a verbal consent of the CIH projects. Official written consent was merely obtained (See Appendix iv).

A pilot testing period was performed for the first 2 weeks of June 13-26 using the villages Chumkabey and Roneas. A motorbike was used to travel between villages. This was particularly useful given the narrow and bumpy roads of rural Cambodia. Since the questionnaire was altered after the pilot test, the results of these two villages are incomplete. Upon consultation with SAWAC, the two sections that were added were section E: Engineering Considerations and section F: Gender Questions. An updated version was given to Dr. Men Sothy, Director of the Ministry of Health's Operational District in Kep.

Section E was developed after more engineering aspects of water safety were considered. This section looked at the quality of well construction and the structure of latrines if they were used.

It has been frequently observed that women play a central role for water distribution in developing countries. Women are most often involved with cooking and cleaning duties, and are therefore most influential in terms of ensuring safe water is used by the family. Section F tries to discover the extent that women are involved in various aspects of establishing safe water for the family. The questions investigate who has been educated on keeping clean water, who brings water home to the family, who cleans water jars, and who cleans the well area.

The sample size of 200 was obtained with 20 interviewees per village. A convenience sample was taken. The villages surveyed were based on distance from the road. It was hypothesized that the further away from the main road, the more impoverished a village would be. Consequently, the following list of villages was compiled:



	<b>Village</b>	<b>Commune</b>
1	Chumkabey	Pong Tuok
2	Roneas	Pong Tuok
3	Angkoul	Angkoul
4	Prey Takoy	Pong Tuok
5	Okrasa	Okrasa
6	Kampong Troy Lak	Prey Thum
7	Kep	Kep
8	Chom Bok	Okrasa
9	Koh Sam	Angkoul
10	Toul Sangam	Angkoul

**Table 2: List of villages surveyed**

In addition, representation from each commune was also considered, and it was ensured that at least one village per commune was selected with more populated communes having more villages surveyed.

As surveys were completed, the results were recorded in an Excel spreadsheet and tabulated. For Section A-F, the majority of the responses required frequency counts of a variety of responses. There was always an “other” response when executing the survey so that more responses were added if they did not fall into a category. Averages were calculated and results from different villages were compared. Histograms were useful in summarize this massive quantity of data. A similar analysis was performed for the questions asked to those who actually became sick with vomiting/diarrhea/typhoid.

For open-ended qualitative questions, responses were noted in point form and saved into a Word document. The qualitative responses were evaluated using grounded theory. After the interviews, responses were reviewed and notes were made to clarify any of the written responses that might have been recorded quickly; this was done soon after the completion of interviews when the investigator could still remember the specific responses. Strauss and Corbin defined open coding as “the process of breaking down, examining, comparing, conceptualizing and categorizing data.”<sup>13</sup> Upon comparison of notes, several themes for each question would repeat in different interviews, which lead to the generation of categories. All of the responses were gathered for each question into one document to help the investigator get an overall impression of the responses. At this point, coding was done for each question by studying the responses, which led to a natural categorization of several responses. Since the open-ended responses were not that extensive probably because of inherent summarization by Mr. Chim, a more complex sub-categorization was not required. After these analytical categories were generated, the investigator would memo the notes to try to come up with hypotheses or reasoning that would allow for some basic conclusions.

Profiles of the Kep province were acquired from the Ministry of Rural Development’s SEILA program. This data allowed for comparison and further appreciation of the situation in each village regarding population, families with

<sup>13</sup> Strauss, A, and Corbin, J. *Basics of qualitative research: Grounded theory procedures and techniques*. London: Sage, 1990.

“water in the house”, percentage of families with “Other [water] sources” by year, and with water sources that were “within 150m”. This information nicely coincided with the information gathered in Section D regarding preferred water sources. The official demographic data with the population sizes of each village helped to put data from this study into perspective.

## **Results and Discussion**

### ***Sections A-F***

Section A of the questionnaire gave the investigator an idea of the background of the respondents. Overall, most respondents were in their 30-40s (Figure 5). Overwhelmingly, most were female (Figure 6) and farmers with the occasional vendor (Figure 7). The large proportion of female respondents is most likely attributed to the fact that most men were farming during the day and unavailable for questioning.

Figure 5

Figure 6

Figure 7

The general income varied from ~ \$28-55 (US) (Figure 8). The income is important to bear in mind when considering whether households can afford a water purifier or rainwater catchment, as asked in Section D. The number of people per household was approximately ~5-7 (Figure 9); therefore, the number of people for which the survey is accounted is about ~1000-1400.

Figure 8

Figure 9

In Section B, it was found that most respondents did feel that unclean water was a major issue (Figure 10). The percent among all household members who were accounted in the survey who had a waterborne disease in the past 2 weeks was about

Figure 10

Figure 11

15-30% (Figure 11). Although the exact number for incidence does vary between villages and some of these cases could conceivably be attributed to food going bad, this 15-30% is extraordinarily high for the short period of only two weeks. This is strong indication that sickness from polluted water is indeed a major problem. According to the open-ended questioning about diarrhea, most people thought that diarrhea is watery excrement; others associated diarrhea with a 'virus' and knew that it can be dangerous. This question was asked specifically because it was casually observed that many Cambodians do not think that loose stools are severe enough to be considered diarrhea; the condition had to have reached a level where only water was being excreted to be called diarrhea. This question was asked to ensure that for the rest of the interview, we were clear that diarrhea referred to loose runny stools or watery excrement.

There was great variability in terms of the primary medical authority sought given the circumstance that a household member was ill (Figure 12). Bearing this in mind, health education should then be targeted to the appropriate party. For this project, clinic and health centre were grouped together. It was pointed out by Mr. Chim midway through the study that in Cambodia, clinic refers to a call-in doctor. Unfortunately, the difference between clinic and health centre were not

distinguished. From the data, it seems that the province Kep would benefit from education regarding waterborne disease geared towards the pharmacy and village health volunteer. It was surprising that the Traditional Healer seems to play a minimal role in terms of helping villagers with sickness from polluted water. The health centre/clinic is not always the predominant source for help. The main message that villagers were told by the medical sources was how to take medications while about 43% of villagers were told to boil water for drinking and 22% were advised about food preparation. Only about 10% were given various suggestions about improving conditions as a whole possibly highlighting a possible issue for education.

To investigate the quality of care at the Health Centres, Chimda Sokh<sup>14</sup>, a healthcare worker, at Okrasa Health Centre, was interviewed. It was found that she was very knowledgeable about the critical signs of dehydration and waterborne

Figure 12

diseases in general. She said that the overwhelming majority of patients are children, and there are about 10-20 cases/month from polluted water or bad food. The treatment is generally paracetamol (acetaminophen) and ORS. If there is blood in the diarrhea, metronidazole is used, but this is a very rare occurrence. From this, it can be surmised that the health centre workers seem to be well-equipped to handle illness from waterborne diseases, but the drug sellers often do not have any medical training at all and yet many seek help from them due to convenience. Therefore,

Figure 13

much can be communicated to the villagers via the pharmacy. One point that needs to be disclosed to villagers is the inefficacy of an injection to treat waterborne disease. Despite this, pills and injection (Figure 13) remain the standard for treatment.

The majority of people felt that advice given at these sources for medical help was effective. However, when asked whether the respondent would know where to get ORS, 30-78% answered 'no' (Figure 14). This lack of knowledge can easily be rectified by informing villagers that ORS can be acquired from the health centre or the pharmacy for ~500 Riel. Most respondents felt that they could afford this. Villagers could also be taught how to make homemade ORS: 1 cup of water, teaspoon of sugar, and pinch of salt. This remedy is actually discouraged in Canada, but in Cambodia, commercial ORS might be unaffordable for some.

Figure 14

When asked about typical symptoms and signs of dehydration, about 34% of respondents did not know what they would be. Among those who knew, most cited dry arms/legs/face/mouth/nose. Others mentioned weakness and thirst. For the scenario-based questions regarding dehydration in Section C, almost all respondents correctly answered that medical help would be sought under three days if diarrhea/vomitings should persist. Similarly,

Figure 15

almost 100% said that they would bring a patient in for medical help should there be fever, dry skin, drowsiness, or weakness. As predicted, many had not encountered a baby who cried without tears (Figure 15); consequently, many answered that they did

Figure 16

not know whether this warranted medical help. There were similar results when asked about blurred vision. Both are very late-stage signs of dehydration and unlikely encountered, but it could be easily taught to villagers. In certain villages, it was surprising to find that blood in the diarrhea did not seem to elicit enough concern to seek medical help (Figure 16).

Figure 17

Section D looked at practices for prevention of acquiring waterborne diseases. From the hand-washing questions, it seemed that very few people consistently washed their hands with soap. Similar graphs were generated as Figure 17 for hand-washing after using the toilet, before eating, and after washing the baby's bottom.

Figure 18

Looking at boiling water practices, 100% of respondents knew to boil water for over the recommended 15 minutes. While most claimed that they would regularly boil water for cooking, it was not the case that water would always be boiled for drinking (Figure 18). Most do not

use bottled water either. With exception of a handful, iodine or alum salts to purify water were not used generally.

There was a difference in water source depending on the season (See Figures 19 and 20).

Figure 19

Figure 20

N.B. Wet/Dry season was not differentiated during surveying Chumkabey and Roneas

During the dry season, villagers rely mostly on the well or nearby ponds. In most villages, many residents would take advantage of the natural rain during the wet season. Curiously, in Okrasa, it seems that residents persist in using the wells. The results for Chumkabey and Ronease are inaccurate since the original question was: "From where do you get most of your water? Please rank." This did not account for the different seasons. In any event, a significant number of wells are still used during the wet season despite the abundance of naturally purified clean water. Subsequent questions attempted to investigate why rainwater is not used as much as possible.

From the open-ended qualitative responses for “Why don’t you use rainwater more often?” the predominant emerging theme was: “No storage.” The problem did not seem to be lack of instrumentation to capture the water, but the ability to retain the water. There were a dozen who also mentioned that the rainwater was perceived to be dirty and that the iron from the roof or smoke from the cooking fire would contaminate the water.

From the **Figure 21** SAWAC reports, it was indicated that villagers occasionally find a difference between pond and well water, usually citing pond water as better tasting. Apparently, some feel that pond water is more natural and flavourful despite the fact that it is in fact more prone to pollution than well water. This could partly contribute to higher incidence of sickness from polluted water. Fortunately in this study, it was found that of those who felt there was a difference in pond and well water, well water was usually preferred over pond (Figure 21).

is

Figure 22

The primary area for urination/ defecation was usually field, jungle, or alternatively a latrine, which was most often simply a hole dug out in the ground that might lead to a short distance from the house (Figure 22). Fortunately, only very few people stated that a major body of water was used for this purpose, but 8% did state that a body of water was close to the area of urination/defecation.

A noticeable number of household members swam in the local pond/lake. To arrive at Figure 23, the total number of household members was added to calculate a percent of people who swam



Figure 23

out of that number. Swimming should really be discouraged as the ponds are directly beside farming fields and often have cattle bathing in them. Anecdotaly, a woman in Koh Sam told the investigators about a tragic incident when her son became sick after swimming in the nearby pond and passed away soon after. Since then, she has not allowed any of her relatives to swim. It is tempting to swim given the extremely hot temperatures in Cambodia, but bathing from the

water jar containing clean water should be practised.

Figure 24

N.B Roneas was based on sampe size n=10

Ownership of a water purifier was explored. As mentioned before, Red Cross had distributed several Rabbit water purifiers in through out the Kep province. Most villages, excepting Chom Bak, had about 10-25% of households with water purifiers (Figure 24). There have been no studies in Kep definitively confirming that the water purifiers have reduced incidence of disease, but the purifiers do claim reduction by 70% of microbes.

The effectiveness of these purifiers is perhaps another avenue of exploration for future research projects. The major factor that prevented people from getting a water purifier by themselves was lack of money.

When asked about factors that prevent acquiring clean water, nearly everyone said lack of money, 5% attributed

Figure 25

this to habit, and 21% stated that they lacked time to boil water. 36% felt that are no barriers to acquiring clean water.

Figure 26

Section E explored the quality of the wells used. According to Figure 25, the majority of the wells are built by the villagers themselves and excepting Angkoul, few by the government or organizations that would probably guarantee a better quality well. Most of these wells are surface wells and are therefore more susceptible to surface run-off of livestock excrement. The

average depth of the wells surveyed is depicted in Figure 26. About half of the wells are below the desired 8m for a surface well. The deeper wells in Prey Takoy and Koh Sam are drilled wells. It is suspected that there might be some sample bias here because the number of drilled wells per village is very few normally; therefore the data is based on only a small number of wells.

Figure 27

The overall quality of the wells is poor. Most wells do not have hand pumps (Figure 27) according to the respondents who described the wells they used. Sometimes, multiple wells are used, which explains the response 1 No/1 Yes because 1 well does have a hand pump, while the other does not. In villages other than Kep and Koh Sam, well platforms were not always present (Figure 28). Platforms are important to protect the wells from surface run-off. Additionally, a lid for the well is another primary method of water source protection, which a number of households were

Figure 28

missing especially in Angkoul, Okrasa, and Toul Sangam (See Figure 29). Among those wells that had alterations, most repairs involved making the wells deeper.

In describing the quality of latrines, most of these 'latrines' were basically holes in the ground that might lead to transportation of the sewage to a few metres away from the house.

Figure 29

Finally, the last issue that was addressed was the differing roles of men and women regarding water distribution in Section F. According to Figure 30, it was evident that many villagers have not been educated about water sanitation.

Figure 31 indicates that there is still a significant number of people who have not been educated about water sanitation; refer to the bars marked 'N/A'. The graph looks

quite complicated, but if the reader isolates the bars indicated by 'Dad', 'Parents', and 'Together', the reader will see that for the majority of households, the mother is usually educated. In terms of cooking, the mother is most often the member who is responsible for preparing meals (See Appendix V). Interestingly, the women again play a major role in bringing water back to the home, but children seem to also have a significant part in this. Men have a larger role in water transportation than in other aspects of water sanitation. The cleaning of water jars is also mostly performed by women (Figure 32). Therefore, the results indicate that education should be directed, but not restricted to women since children often fall under the guidance of their mothers and help with cooking and fathers play a larger role in transporting water.

Figure 30

A fairly substantial percent of villagers do not clean their wells consistently, thus possibly leading to contamination (Figure 33). When asked who usually cleans the wells, the usual case was

Figure 31

that the  
nearest  
neighbour to  
the well or the  
villagers as a  
whole would  
carry the  
responsibility.  
There was no  
clear gender  
favouring for  
this task.

Figure 32

Figure 33

### ***Patient Data***

The number of households with a member who was sick with diarrhea and/or vomiting or typhoid within the past 2 weeks was about 15-30% as mentioned above. Figure 34 illustrates the percent of people who were sick in relation to the total number of people accounted in each household. 2.1-9.5% of households surveyed had 1 or more incidences of sickness in the previous 2 weeks; this percent is a concern

Figure 34

despite the fact that the symptoms of diarrhea and vomiting are non-specific. As shown in Figure 35, most of the cases involved diarrhea or diarrhea with vomiting, which would seem to strongly point to a gastrointestinal infection. Since the illness was documented within

the past two weeks, the cause would have to be something that occurred quite frequently, and the chance that the cause for the cases was something like Inflammatory Bowel Disease or celiac disease is unlikely; these causes would probably have been described as chronic and would not resolve after only a few days.

Figure 35

Blood in diarrhea was not common, but given the timespan of only two weeks, the rate is actually rather alarming (Figure 36). The incidence of fever would also point towards an infectious cause (Figure 37). Constant fever would be an indication for typhoid fever; therefore according to Figure 38, there may have been some underreporting of typhoid fever.

Figure 36

Figure 37

Figure 38

Figure 39

There were further indications that illness from waterborne disease is quite severe. Almost all respondents claimed that the sick individual had lost weight (Appendix V). Most respondents also reported a decrease in level of consciousness (Figure 39).

Although,  
most

Figure 40

respondents claimed that the sick member drank more, there was still a number of people who only drank the same or even less (See Figure 40).

Proper education about the importance of hydration should correct this.

Figure 41

Almost all respondents stated that drugs were used to treat the illness (See Figure 41, once again emphasizing the important role of drug sellers in Kep.

## Strengths and Weaknesses

Since no study of this kind had been conducted in Kep, it is unique and meant to provide a general overview of the safe water situation in the province. From this report, it is hoped that subsequent investigators can expand on any of the sub-headings used in the questionnaire.

The strengths of the study include its simplicity, efficiency, and presence of some flexibility as the investigator interacts with the patient and is able to read non-verbal as well as dictated cues. Furthermore, the survey was inexpensive, many questions were asked in the same interview, and standardization allowed for comparative analysis. The case study approach was used, as a larger cohort such as an entire village would be difficult to evaluate within the time span and fewer villages would have been investigated. Overall, the design of the project was well suited to the time constraints. Consequently, the target number of 200 participants was reached, and the project was on schedule for the entire timetable. The number of interviewees is an adequately large sample from which to draw some conclusions.

An obvious weakness to the study is possible miscommunication with the translator. Despite the fact that Mr. Chim wrote out the translation in Khmer and consulted with another colleague, Ms. Qun Ty, it is of course still possible that the questions were not translated clearly or consistently.

Randomization was difficult because houses are not lined up in orderly roads and transportation to certain areas of villages was challenging particularly in monsoon rainy weather. Without randomization, conventional statistics using chi-square are inaccurate since it is with randomization as its basic tenet that all statistical tests are based. As such, the results of this study should be utilized to look for trends; it is hypothesized that the actual numbers would be variable if another sample were to be taken of each village.

A definite limitation to the study was the ability to recognize a waterborne disease by using the symptoms of vomiting and diarrhea. Both vomiting and diarrhea are non-specific. Vomiting can be caused by such conditions as nausea or dehydration, and diarrhea can be caused simply by stress. Illness from food that has gone bad can also look like an affliction with a waterborne disease. Ideally, a lab test using stool samples would be necessary to confirm the presence of a waterborne microbe, but these facilities are not available. Furthermore, it would be impossible to test every person who developed vomiting/diarrhea when they were sick. In addition, since only 2-4 respondents claimed that a household member had been sick with diarrhea/vomiting in the past 2 weeks per village, the results are based on a small sample size and are likely not generalizable.

Since the surveys were conducted over a 2 month period, there is some variability in the environmental conditions. For example, rain got progressively heavier as the summer unfolded, which might have affected the incidence of waterborne disease. Additionally, the villages Chumkabey and Roneas were not completed and really should have been repeated for a complete data set.

For the scenario-based questions of Section C, there perhaps could have been some response bias, as the respondent might have realized that all the scenarios listed referred to possible signs of dehydration. It is not uncommon that patients look for a doctor's approval and might answer in order to garner this approval. Therefore,



a respondent might have answered that he/she would seek help for all the scenarios listed because he/she suspected that a medical expert would have advised this.

In general, there are of course inevitably some inconsistencies from human error and a definite component reliant on both the investigator's and translator's interpretation and judgement. With practice, effects of these inconsistencies would have been minimized. For example, the question "What do you think diarrhea is?" was changed from "What do you consider diarrhea?" The original question yielded responses pertaining to what respondents thought caused diarrhea rather than the signs of diarrhea or often times, respondents would answer "don't know". It was not clear whether respondents truly did not know what diarrhea was or whether they did not understand the question. Mr. Chim tried phrasing this question various ways in Khmer until we arrived with the aforementioned question, which seemed to convey the proper message.

### **Conclusions and Recommendations**

In conclusion, it was confirmed according to the survey that water sanitation remains a major obstacle to better health for Kep residents with 15-30% of people accounted in the survey having an illness suspected to be related to a waterborne disease bearing in mind that there were about 5-7 people per household. Cases that were reported seemed relatively severe with reports of lost weight, accompanying fever, and occasional blood in the diarrhea, which is disconcerting.

It seems that the definition of diarrhea might not be clear to everyone, which indicates the need for education. Although there is variation, most residents seem to refer to the pharmacist or village health volunteer for opinions on medical issues. This trend is logical since these two sources would be the most convenient as opposed to travelling potentially very long distances to see a doctor at the hospital. For example, one education goal would be to inform residents on the incorrect notion that an injection, an unnecessary expenditure, implies better treatment. Residents could also be told simply how to get ORS if needed or how to make homemade ORS. Since 34% of respondents could not identify without prompt what the signs for dehydration are, this would also be an easily addressable education point. It was encouraging though to find that if a person had fever, dry skin, drowsiness, or weakness, virtually all respondents would be adequately concerned to seek medical help. On the other hand, it was rather puzzling to find that villagers in Chumkabey, Ronease, and Angkoul did not think that blood in the diarrhea called for medical help. From the interview with Chimda Sokh, it appears that the clinic workers are adequately knowledgeable about treatment of waterborne diseases and dehydration.

Admittedly, most felt that lack of money was the major reason for lack of clean water, but there are still small adjustments that can be made to improve water quality. Regarding prevention of contracting waterborne diseases, several practices were investigated. Handwashing practices need to be strongly encouraged. A future study could look at whether soap is affordable for an average family that makes about \$25-55/month. Although all respondents were aware of how long needed to be boiled, not all would boil water for drinking purposes. It was noted that the primary water source varied with season. Most villages, with the exception of Okrasa, relied on rain during the wet season. It is strongly advised to the Ministry of Health that the

use of rainwater be encouraged as much as possible. Usage of nature's water sieve is more effective than any man-made water purifier. The impediment to this as discovered in this survey is storage. While urination and defecation usually do not occur directly in a body of water, there is still concern that these events may occur close to a water source. 3-20% of those accounted in the survey for each village would swim; this activity should really be strongly discouraged as the body of water, unless it is the ocean is almost definitely polluted.

The Red Cross effort of distributing water purifiers should be supported, but it should be recognized that education is needed to complement this provision of purifiers. As demonstrated in this study, behavioural practices such as hand washing, boiling water, and usage of clean water sources need to be emphasized as well.

The wells tended to be of poor quality and deeper wells that provided cleaner water that would not be subject to surface run-off would solve many problems. Ideally, wells ought to have a proper platform and cover, which the majority of wells in Kep do not have. Additionally, they need to be cleaned regularly. Finally, since women play such a major role in bringing water to the family, education should be directed towards them.

For this study, the one area, which really could have been delved into more significantly is the issue of latrines and locations for urination/defecation. It was out of the scope of this study to do a very thorough evaluation of the quality of "squatters" or the effects of urinating/defecating 1m from the house. This would have required the expertise of a civil engineer or environmental engineer with more knowledge about water systems and sewage infrastructure. Only questions were asked about urination/defecation; actual documentation of where sewage drained, the distance from the house to the usual field for urination/defection, etc. were not noted.

An entire project could also be dedicated to wells. Proper mapping of wells and assessment of their quality would have been useful to understand accessibility to water and how safe water is from these wells. To get meaningful data however, lab tests on water samples from various wells would have to be conducted.

## **APPENDIX II**

### **Consent Form to Participants**

**(As followed by the guidelines of University of Toronto's Determinants of Community Health II course)**

From Researcher (s): Principal Investigator: Cynthia Pun; Supervisor: Dr. David Zakus

Date: \_\_\_\_\_

Dear \_\_\_\_\_

Thank you for considering to participate in my research project. I am a Canadian medical student from the University of Toronto and doing research as part of my project with the Centre of International Health. I want to provide you with information so that you can decide whether or not you want to participate in my study. Participation is voluntary, and, should you decide to participate, you are free to stop at any time without penalty. You will not receive direct compensation for your participation in this study.

Please feel free to ask me other questions if you want. At the end of the letter, I will ask you if you agree to participate in the study. The translator will sign on your behalf to indicate that verbal consent was given. If you do not want to participate, please inform the translator.

The **name of the project** is: Status and Knowledge of Waterborne Diseases among Residents in Kep, Cambodia

The **nature and purpose of the research** is to study the occurrence and knowledge of waterborne diseases among residents of villages in Kep. The study will be conducted from June – August 2005, and each interview will last approximately 20-30min.

The **procedure of the study** involves interviewing people about water sanitation. We hope to interview about 16 villages.

Since I will be giving the information that I learn to the local health centre, the OD office and the Ministry of Health, the **potential benefits of the study** include possible improvements to water sanitation in your village. The study will tell the ministry how water sanitation is affecting your area. **Potential risks of the study** might include concerns of confidentiality and fears that this interview will affect regular medical treatment. I am assuring you that this will have NO EFFECT on your medical treatment, and all responses will be kept entirely confidential without identifying data recorded. All completed interviews will be kept at the Centre of International Health.

If you have questions about the study or would like to know about the results, you can contact Dr. Bunthoeum Thom at the Centre for International Health office in Kep.

Do I have your permission to ask you some questions?

Yes [ ]

No [ ]

I, Khut Chim, certify that I have translated this information into Khmer for the respondent and he/she understands all aspects of what this letter entails. I certify that the information provided to me by the person with regards to consent is true.

\_\_\_\_\_

\_\_\_\_\_

Signature of Translator

Date

**APPENDIX III**

***Surveying Tool for assessing  
Status and Knowledge of Waterborne Diseases among Residents in Kep***

Name: \_\_\_\_\_

Date & time: \_\_\_\_\_

Location (village): \_\_\_\_\_

**Section A: Demographic Information**

- 1) Age: \_\_\_\_\_
- 2) Sex (Circle One): \_\_\_\_\_ Male \_\_\_\_\_ Female
- 3) Family Role: \_\_\_\_\_
- 4) Occupation: \_\_\_\_\_
- 5) How much income does your family earn per month (US\$)? \_\_\_\_\_
- 6) How many children are in this house? \_\_\_\_\_
- 7) Including yourself, how many are in your household? \_\_\_\_\_
- 8) What level of education have you had?
  - i) None
  - ii) Primary, does not read
  - iii) Primary, reads
  - iv) Secondary
  - v) Post secondary

**Section B: Incidence of Waterborne diseases**

- 9) In your opinion, getting sick from polluted water is:  
1                                  2                                  3                                  4  
Not a problem      Small problem                  Moderate problem                  Major problem
- 10) What are the signs and symptoms of diarrhea?  
\_\_\_\_\_  
\_\_\_\_\_

\*N.B. After answering, prompt the interviewee that for this questionnaire, diarrhea refers to loose runny stools and watery excrement.

- 11) Has anyone ever died after severe vomiting or diarrhea?  
**No** ☐ **Yes** ☐ How many have died? \_\_\_\_\_
- 12) In the last 2 weeks, how many people in your family have been sick with diarrhea and/or vomiting or known sickness (eg. Typhoid, cholera)? \_\_\_\_\_. **If none, skip to 13**  
What was/were the sickness(es) if known? \_\_\_\_\_

For each person who was sick with vomiting and/or diarrhea:

**Patient #** \_\_\_\_\_

- i. How old is the person? \_\_\_\_\_
- ii. How many times did this occur in the past 2 weeks? \_\_\_\_\_
- iii. Did the person experience diarrhea, vomiting, or both in the past 2 weeks? \_\_\_\_\_
- iv. If there was diarrhea in the past 2 weeks, was the diarrhea:  
Solid          Soft          Liquid          Watery **N/A** ☐
- v. If there was diarrhea in the past 2 weeks, was there blood in the diarrhea?  
**No** ☐ **Yes** ☐ **N/A** ☐ How many times? \_\_\_\_\_
- vi. If there was vomiting in the past 2 weeks, was there blood in the vomit?  
**No** ☐ **Yes** ☐ **N/A** ☐ How many times? \_\_\_\_\_
- vii. Was there ever an associated fever in the past 2 weeks with the vomiting/diarrhea?  
**No** ☐ **Yes** ☐ How many times? \_\_\_\_\_  
Was it constant or did the fever come and go? \_\_\_\_\_
- viii. Was there ever associated stomach pain?  
**No** ☐ **Yes** ☐ How many times? \_\_\_\_\_
- ix. How long was the person sick? \_\_\_\_\_
- x. Was there ever an increase in bowel movements in the past 2 weeks?  
**No** ☐ **Yes** ☐ How many times? \_\_\_\_\_
- xi. In your opinion, did the person lose weight in the past 2 weeks?  
**No** ☐ **Yes** ☐
- xii. Did the person ever have reduced awareness or seem less awake?  
**No** ☐ **Yes** ☐ How many times? \_\_\_\_\_  
How would you describe this?

Drowsy                      Unaware of surroundings  
(sleep more often)                      (almost fainting)  
(eating less)

- xiii. Overall, the person drank:                      Less                      Same                      More
- xiv. Overall, the person ate:                      Less                      Same                      More
- xv. Were any of the following used (Y/N)?

Oral rehydration salt	
Water with added salt/sugar	
Was the water clean (boiled, bottled, rainwater)?	
Porridge (Khmer: borbor)	
Pop	
Juice - fruit	
- powdered	
- canned	
- sweet coconut	

- xvi. Were any drugs used? **No** ☐ **Yes** ☐ What drugs were used?  
Paracetamol   Amoxicillin          Don't know                      Other \_\_\_\_\_
- xvii. In your opinion, did the sickness interfere with the work of that person (if applicable)?  
**No** ☐ **Sometimes** ☐ **Yes** ☐ **N/A** ☐
- xviii. In your opinion, did the sickness affect the person's everyday activities (e.g. washing, dressing, eating)? **No** ☐ **Sometimes** ☐ **Yes** ☐

13)

- i. If you or anyone in your family is very sick because of diarrhea or vomiting, to whom do you go for help?  
Please rank all that apply:

No one, self-treat	
Traditional Healer	
Village Elder	
Village Health Volunteer	
Health Centre/Clinic	
Hospital	
Pharmacy/ Drug seller	
Relatives/Friends	

Other: \_\_\_\_\_

- ii. What does this person advise you to do? N/A ☐

\_\_\_\_\_

- Does the advice help usually? N/A ☐ No ☐ Yes ☐
- iii. If you have gone to the pharmacist for diarrhea/vomiting, did you get: N/A ☐
- pills injection neither other \_\_\_\_\_
- iv. Do you know where to get oral rehydration salts if it were needed? No ☐ Yes ☐
- v. Do you think that you would have enough money to buy oral rehydration salts (300-500 Riel/package)? No ☐ Yes ☐

### Section C: Protection against Dehydration

- 14) What do you think are the signs that someone does not have enough water in his/her body?

\_\_\_\_\_

- 15) In the following situations, when do you look for help?

- i. A person has been sick with vomiting/diarrhea for:  
<1 day/ 1 day/ 2 days/ 3 days/ 4 days / 5 days/ 6 days/ ≥ 1 week
- ii. A person has not urinated for over 12 hours No ☐ Yes ☐ Don't know ☐
- iii. A child does not produce any tears when crying No ☐ Yes ☐ Don't know ☐
- iv. A person is drowsy No ☐ Yes ☐ Don't know ☐
- v. A person does not seem aware of his/her surroundings No ☐ Yes ☐ Don't know ☐
- vi. A person's skin feels dry No ☐ Yes ☐ Don't know ☐
- vii. A person has blood in the diarrhea No ☐ Yes ☐ Don't know ☐
- viii. A person has blood in the vomit No ☐ Yes ☐ Don't know ☐
- ix. A person has a fever No ☐ Yes ☐ Don't know ☐
- x. A person feels weak No ☐ Yes ☐ Don't know ☐
- xi. A person has blurred vision No ☐ Yes ☐ Don't know ☐

### Section D: Protection against Waterborne Diseases

16)

- i. Do you wash your hands with soap after going to the bathroom?  
Never ☐ Rarely ☐ Sometimes ☐ Usually ☐ Always ☐ Wash, but w/o soap ☐
- ii. For the person who cooks, does he/she wash his/her hands with soap before cooking?  
Never ☐ Rarely ☐ Sometimes ☐ Usually ☐ Always ☐ Wash, but w/o soap ☐
- iii. Do you wash your hands with soap before eating?  
Never ☐ Rarely ☐ Sometimes ☐ Usually ☐ Always ☐ Wash, but w/o soap ☐
- iv. Do you wash your hands with soap after cleaning the baby's bottom? N/A ☐
- Never ☐ Rarely ☐ Sometimes ☐ Usually ☐ Always ☐ Wash, but w/o soap ☐

- 17) Do you boil water when using it for cooking? **No** ☐ **Sometimes** ☐ **Yes** ☐  
 Do you boil water when using it for drinking? **No** ☐ **Sometimes** ☐ **Yes** ☐  
 For how long do you boil the water? \_\_\_\_\_ minute(s)

18) **Water Sources:**

- i. From where do you get most of your water during the dry season (March-May)? Please rank all that apply:

Pond/Stream	
Lake	
Well	
Rainwater	
Bottled Water	

Other: \_\_\_\_\_

- ii. From where do you get most of your water during the wet season (June-April)? Please rank all that apply:

Pond/Stream	
Lake	
Well	
Rainwater	
Bottled Water	

Other: \_\_\_\_\_

- iii. In the past 2 weeks, how many times has your family used bottled water?

**None** ☐ **1x** ☐ **2x** ☐ **3x** ☐ **4x** ☐ **5x** ☐ **≥5x** ☐ **≥10x** ☐

- iv. If the main source is from a pond, stream, lake, or well, how many of these are in your area and how far are they?

- 
- v. If rainwater was not ranked #1 in 18i/ii: Why don't you use rainwater more often? **N/A** ☐

- 
- vi. If rainwater was not ranked #1 in 18i/ii: would you consider buying a plastic sheet that could catch rainwater for \$4.00-\$5.00? **N/A** ☐ **No** ☐ **Yes** ☐

- vii. Do you think that there is a difference in taste of pond and well water? **No** ☐ **Yes** ☐

If yes, which do you prefer? \_\_\_\_\_

19)

- i. Do you ever use tablets to clean water?

**No** ☐ **Yes** ☐ **Don't know** ☐

How often if yes? \_\_\_\_\_

- 20) Where do you wash your clothes? Please rank all that apply:

Pond/Stream	
Lake/Ocean	
Water basin	

Other: \_\_\_\_\_

21)

- i. Where do you urinate/defecate? Please rank all that apply:

Toilet	
Field	
Hole in ground/Latrine	
Jungle	
Lake/Ocean	
Pond/Stream	

- ii. Are any of these close (<20m) to where you get your water or where you might store water?

**No** ☐ **Yes** ☐ **Don't know** ☐

If yes, which ones?

- 
- 22) Does anyone in your family swim in the lake, pond, or stream?

**No** ☐ **Yes** ☐

How many people swim and how often? \_\_\_\_\_

23) What in your opinion prevents you from getting clean water?

\_\_\_\_\_

24) Do you have a water purifier? **No** ☐ **Yes** ☐

25)

i. Would you consider getting a purifier, which costs \$7.50? **N/A** ☐ **No** ☐ **Yes** ☐ **Don't know** ☐

ii. If no, why not?

\_\_\_\_\_

### Section E: Engineering Considerations

26) If you use a well... **N/A** ☐

i. who built the well? \_\_\_\_\_ **Don't know** ☐

ii. how deep is the well? \_\_\_\_\_m **Don't know** ☐

iii. does the well have a hand pump? **No** ☐ **Yes** ☐ **Don't know** ☐

iv. does the well have a platform? **No** ☐ **Yes** ☐ **Don't know** ☐

v. is your well protected (e.g. something prevents material going into the well)? **No** ☐ **Yes** ☐ **Don't know** ☐

vi. have you ever had to repair the well? **No** ☐ **Yes** ☐ **Don't know** ☐

If yes, what had to be repaired?

\_\_\_\_\_

27) If you use a toilet, where does the sewage go? \_\_\_\_\_ **N/A** ☐ **Don't know** ☐

28) If you use a latrine, can you please describe the latrine? **N/A** ☐

\_\_\_\_\_

### Section F: Gender Questions

29)

i. Have you ever been taught how to keep your water clean? **No** ☐ **Yes** ☐

ii. If yes, who in the family has been educated? \_\_\_\_\_

30) Who brings the water back to the home? \_\_\_\_\_

31) Who usually cooks dinner? \_\_\_\_\_

32)

i. If you use water jars, who cleans the water jars? \_\_\_\_\_ **N/A** ☐

ii. How often are the jars cleaned? \_\_\_\_\_

iii. Does the water jar have a lid? **No** ☐ **Yes** ☐

33)

i. Does the well area get cleaned? **No** ☐ **Yes** ☐ **Don't know** ☐ **N/A** ☐

ii. If yes, who cleans the well area? \_\_\_\_\_

iii. How often is the well area cleaned? \_\_\_\_\_



## ***APPENDIX IV***